

Media Briefing

December 2004

BBSRC Research Funding in Psychology

Research Briefing: an introduction to BBSRC funded research in normal human psychology

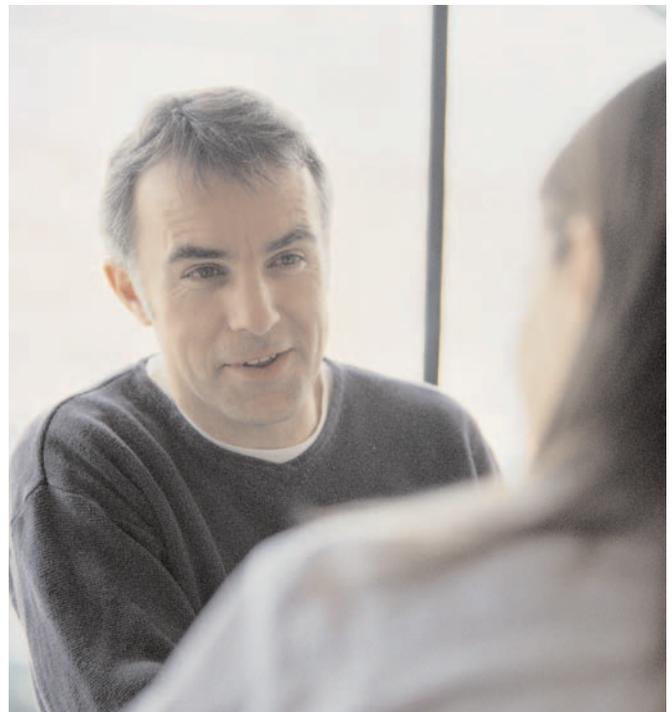
The Biotechnology and Biological Sciences Research Council (BBSRC) funds a wide range of research into normal human psychology, including understanding how the brain acquires, processes and stores information, the evolutionary significance of behaviour, how neural circuits integrate into the nervous system and how neural systems combine to coordinate behaviour.

This briefing is an introduction to BBSRC research funding in psychology and covers research in the following areas:

Decision-making
Perception and Vision
Memory
Language

BBSRC funding in psychology is made through the Animal Science Committee. The Committee supports basic and strategic research on animal function at the level of tissues and systems, aspects of animal behaviour and normal human psychology.

There are three main themes for the research funded directly by the Animal Sciences Committee Integrative Animal Physiology, Mechanisms of Immune Functions and Disease Pathogenesis, and neuroscience and Behaviour. The Neuroscience and Behaviour theme covers research on all fundamental aspects of nervous system functioning aimed at understanding how the brain acquires, processes and stores information. It also encompasses analysis of the functional or evolutionary significance of behaviour



and how adaptive behaviour of the whole organism is generated, including experimental, theoretical and modelling approaches. The theme also includes experimental studies of normal psychological function in humans (excluding disease).

A priority area within the Neuroscience and Behaviour theme is from the neurone to behaviour the aim of which is to encourage interdisciplinary research that will investigate, for example, how molecular signalling pathways function in neural circuits, how such neural circuits integrate into the nervous system as a whole, and how neural systems combine to coordinate behaviour. This priority is intended to establish collaborative programmes of research by combining approaches that might include molecular biology, systems neuroscience, computational neuroscience, and behavioural science.

DECISION-MAKING

The psychology of food choice is supported via the Diet and Health theme of the Agri-Food committee, the aim of which is to increase understanding of the biological and psychological bases of food preferences and of behavioural responses to food. Dr Nigel Lambert and colleagues working in the Consumer Science group at the Institute of Food Research (IFR) are looking into a variety of issues concerning how people think about food and how these attitudes affect their food choices.

Understanding the consumer is particularly important in the light of food-related controversies concerning BSE, Salmonella and E. coli food poisoning, pesticides, high-fat diets and genetically modified foods, which have had significant human health, economic and political consequences. One focus of their research is how consumers perceive a variety of food risks, and how these perceptions differ from those of 'experts'. As differences between official scientific risk assessments and consumer risk judgments stem not only from differences in human information processing, but also from degrees of understandings of the risk concept, this has implications for how precisely one communicates risk information to consumers to effect attitude/behaviour change.

In order to extend this earlier work, the group at IFR

is now looking at how best to involve consumers in the decisionmaking process involved in food policy, which involves consideration of how to measure the effectiveness of participation mechanisms such as consensus conferences and citizen's juries.

Contacts

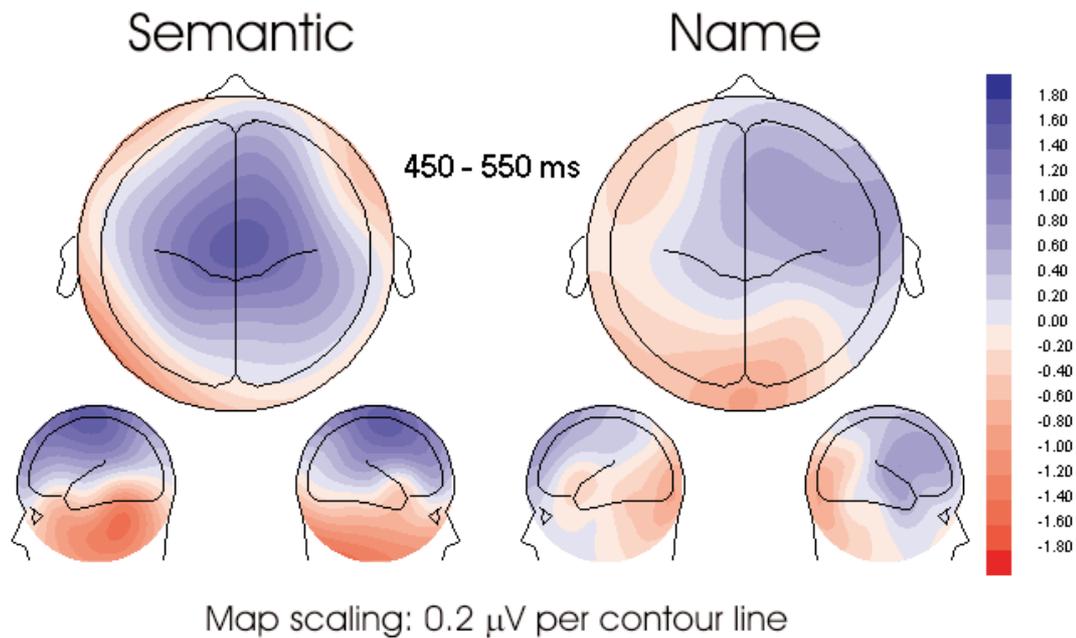
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PERCEPTION AND VISION

Perception is the process by which we gather information from the world around us and is a phenomenon closely related to each of the senses: sight, hearing, smell, touch and taste. The brain does not pay conscious attention to all the information it receives about our surroundings and much research is focussed on how we process and select the significant information. Research at the University of Glasgow carried out jointly by Profs. Schweinberger and Burton is focussed on the processes by which humans recognize familiar faces and how they learn new faces. This project builds on previous work on repetition priming and cognitive modelling of face perception.

Using ERP (event-related brain potentials) correlates, the group have identified neural sources of familiar face recognition and priming (specifically, the fusiform





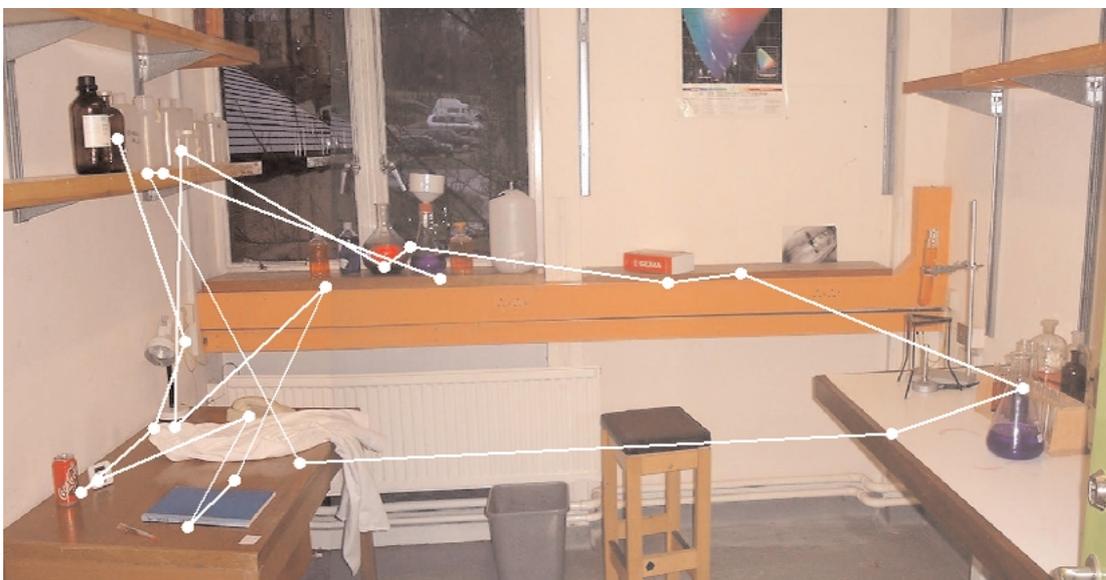
gyrus in the inferior temporal lobe), and of the learning of new faces. They have also established neural correlates for the access of semantic information and names during face identification ('putting a name to a face'). It has also been shown that although semantic information and names can be accessed in parallel rather than in sequence, both are mediated by different brain systems, **see illustration above**.

A distinct aspect of this research is that it motivates a closer conceptual linkage between neurophysiology and cognitive modelling in face perception. Research has shown that the way we perceive the world around us is influenced by the behaviour and characteristics of vision and the eyes themselves. In order to correctly focus on a particular object we must direct our eyes towards it in our field of vision, this can be a complex matter when we are presented with complex

landscapes and views.

Professor Michael Land and Dr Ben Tatler at the University of Sussex are studying the mechanisms of visual interpretation of complex landscapes or scenes and the objects positioned within them. Their research has shown that individuals absorb several types of information from scenes concurrently, and that this information is absorbed over the course of several seconds of viewing. They identified that the general 'gist' and layout of a scene is extracted very rapidly, while subsequent details such as shape and colour of the objects within a scene require longer viewing times.

In more recent work, the group at the University of Sussex have investigated the role of information presentation in influencing perception of scenes. By using real-world displays and computer-displayed



Above: The line trace illustrates the visual path of a participant observing this laboratory scene.

images of the same scenes they have followed the vision scan paths of individuals. This has allowed the researchers to identify that several glances at particular objects are required before accurate information on the shape and relative-distance positioning can be extracted.

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MEMORY

The human brain can encode, store and retrieve information of our experiences through the course of our life, and research into the science of cognition can involve the study of one or more of these neural processes. Two main forms of memory have been proposed – declarative (explicit or conscious) and non-declarative (implicit or subconscious).

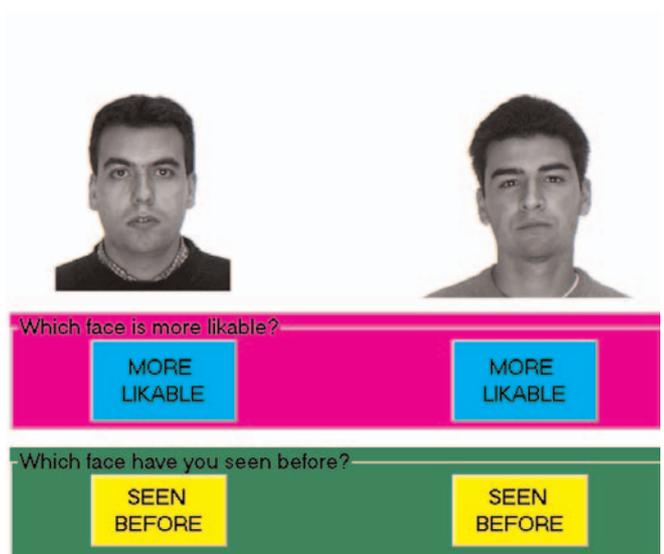
Professor David Shanks and colleagues at University College London are using computational models to investigate the mechanisms involved in selective impairment of declarative memory in patients with temporal lobe amnesia. Their modelling assumes a single form of memory, rather than two forms, and has shown that the different memory probes provided by

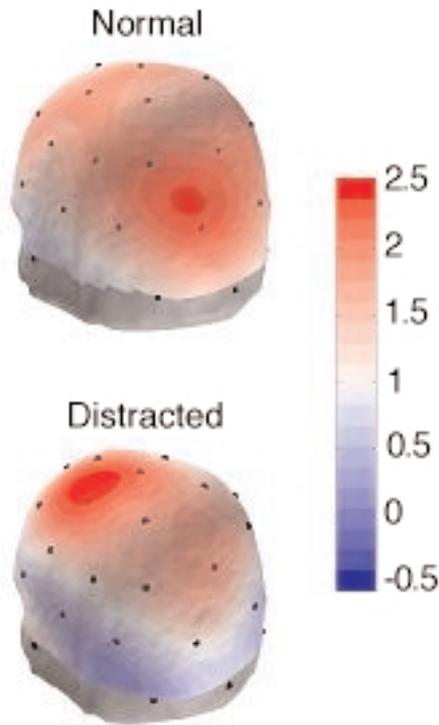
explicit and implicit tests interact in different ways with stored knowledge yielding the pattern of memory breakdown observed in amnesia.

In another line of their research, the group is testing the hypothesis that tests looking at explicit memory mechanisms involve analytical operations while tests of implicit memory would recruit more holistic operations, and that selecting between these types of operation is under strategic control.

Using continuous visual streams of images of faces they have determined that the analytic/holistic dimension is more important to the memory processes involved in determining if a face looks familiar or likeable, **illustrated below**.

Dr Mark Good and colleagues at Cardiff University are researching a link between the loss of ovarian steroids (associated with ageing and the menopause) and a decline in cognitive function. Their initial studies of hippocampal function (an area of the brain critically involved in memory) in rats have shown that the natural variations of oestrogen levels in the normal reproductive cycle of these animals can influence the neural processes thought to be involved in memory formation. When oestrogen levels are high, rats show enhanced synaptic plasticity which suggests that oestrogen can influence the neural substrates of memory in these animals. The research by the group at Cardiff University has now been extended to determine the mechanisms by which oestrogen might influence augmentation of memory function. There is a suggested link between oestrogen and the cholinergic neurotransmitter pathway, which contributes to memory formation. In future work, they hope to further characterise the behavioural effects of loss of oestrogen by using non-navigational tests of memory and attention, tasks closely linked to cholinergic signalling.





Above: The map at the top shows the scalp electrical field during early stages of remembering (400-800 msec post-cue). The map at the bottom is from the same time period, but here remembering has occurred whilst attention is taken up with a secondary task. By comparing these two maps they have isolated a potentially automatic retrieval pathway available when one's full attention cannot be given to remembering.

Traces of subjective experiences from the past lie dormant within our memory until they are reactivated by a cue that serves as a reminder. Memory reactivation is thought to be triggered automatically in the neocortex by the hippocampus, whose function is to associate each cue with a corresponding trace in memory. Following reactivation, the representational contents of the past experience can then be integrated into the ongoing experience. This highly influential framework is largely based on studies of brain-damaged human patients and neuroanatomical and/or neurophysiological work in nonhuman animals and computational modelling. Research is now being undertaken by Dr Kevin Allan and colleagues at the University of Aberdeen to examine whether the intact and normally functioning memory systems of the human brain actually behave as predicted by the framework.

The group at University of Aberdeen utilise a non-invasive measure of the brain's electrical activity, recorded in real-time while remembering takes place. This technique isolates, sequences and maps changes in the brain's functional state, allowing them to explore in vivo the functional neuroanatomy of

remembering. They have recently looked at the effects of attention distraction while participants are trying to retrieve memories **see illustration left**. By comparing these two maps they have isolated a potentially automatic retrieval pathway available when one's full attention cannot be given to remembering.

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LANGUAGE

Language plays a vital role in human society and underpins cognition and social interactions. Speech segmentation – picking individual words from the continuous stream of speech sounds plays a significant role in understanding any spoken message. Written words are separated by white space, but silences between spoken words within a phrase are relatively uncommon. Phoneticians and psycholinguists have identified a number of auditory cues to the placement of word boundaries within the speech signal, but there is no integrated account of how listeners actually exploit these cues when encountered in combination.

Research at the University of Bristol, lead by Dr Sven Mattys, indicates that English listeners do not rely on all segmentation cues equally. Wherever possible, listeners exploit high-level linguistic information (e.g.



semantics, syntax) to segment words from the ongoing speech input. Lower-level phonetic cues, such as variations in speech sounds or timing at word boundaries, are relatively unimportant in clear speech. They propose that lower-level cues may be more useful when high-level information is absent or ambiguous. In situations where speech is less intelligible, for example in noisy locations, speech rhythm becomes more important. This work suggests that speech segmentation operates according to hierarchically weighted cues, a model which makes testable predictions about preferred segmentation solutions in various listening conditions. Work is now on-going to investigate if this hierarchy of segmentation cues is different in languages other than English.

The broad aim of another BBSRC-funded project is to develop current knowledge of brain structures involved in the normal development of orthographic representations, crucial for reading. The work, led by Dr Michal Lavidor at the University of Hull, investigates the cognitive and neural mechanisms involved in the initial stages of visual word recognition. The research programme uses transcranial magnetic stimulation (TMS) combined with divided visual fields presentations. The application of TMS over cortical regions, considered to be involved in orthographic processing, tests the impact of a left or right 'virtual lesion' on reading.

This work has recently shown that TMS can selectively affect the right or left occipital cortex in word classification tasks, and has found evidence to support the split foveal representation theory for word recognition. The challenge now is to establish a model of word recognition assuming that the left and right retinal outputs must be brought together (from the two hemispheres) before other neural processes begin.



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For funding applications and details of existing BBSRC-funded research projects focussing on the theme 'from the neurone to behaviour', visit the Animal Sciences Committee website: www.bbsrc.ac.uk/science/areas/as.html

About BBSRC

The Biotechnology and Biological Sciences Research Council (BBSRC) is the UK funding agency for research in the life sciences. Sponsored by Government, BBSRC annually invests around £300 million in a wide range of research that makes a significant contribution to the quality of life for UK citizens and supports a number of important industrial stakeholders including the agriculture, food, chemical, healthcare and pharmaceutical sectors. BBSRC carries out its mission by funding internationally competitive research, providing training in the biosciences, fostering opportunities for knowledge transfer and innovation and promoting interaction with the public and other stakeholders on issues of scientific interest. For more information on BBSRC go to: www.bbsrc.ac.uk

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